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Tampa Bay Integrated Science Pilot Study
Wetlands Characterization

INTRODUCTION

Coastal wetlands in Tampa Bay consist of mangrove forest and tidal salt marsh. Wetlands buffer storm surges, provide fish and wildlife habitat, and enhance water quality through the removal of water-borne nutrients and contaminants. Substantial areas of both mangrove and salt marsh have been lost to agricultural, residential and industrial development in this urban estuary. Wetlands restoration has been initiated in Tampa Bay. Baseline studies on the current condition of wetlands and historical and prehistorical information is needed for successful restoration planning and evaluation. A major objective of this component of the Tampa Bay pilot project is to characterize wetlands in Tampa Bay beginning with areas that differ in their degree of human-induced disturbance (Fig. 1). The Alafia River area is urbanized, industrialized and dredged, whereas the Terra Ceia area has a history of agricultural use with associated soil berms and mosquito ditches, but has not been farmed for at least 20 years (Fig. 2).

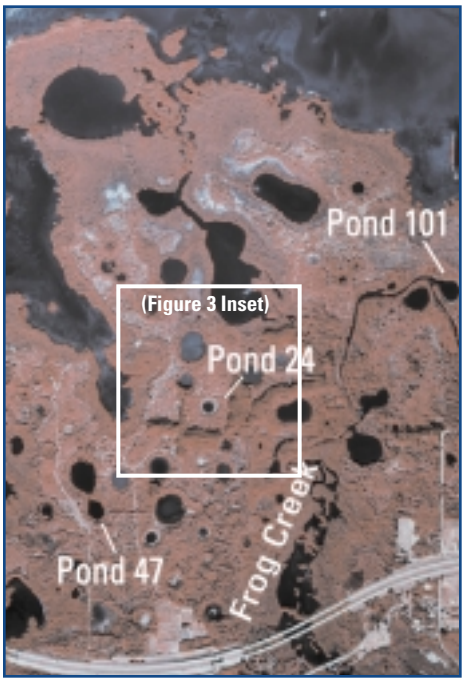

Figure 2. A 1999 color infrared photographic image of the Terra Ceia area. Shallow karst ponds, most of them lined by mangroves, dominate the landscape.

APPROACH

Initial wetland characterization efforts relied on evaluation of historic maps and photographs, and field observations to document:

Wetland characteristics and recent history

- Used historic topographic charts and aerial photos from 1875 to the present to document shoreline configuration, wetland distribution, and surface alterations.
- Characterized mangrove vegetation as to species composition, tree density, size, and health.

Surface and groundwater salinities

- Characterized surface water salinity with standard conductivity meters, and inferred subsurface conductivities from readings of bulk ground conductivities in the top 7.5-15 meters.

Wetland fishes

- Sampled small fishes with beach seines and wire minnow traps in wetland ponds and tidal channels.

Surface Elevation Tables (SET's)

- Monitored millimeter-level changes in surface elevation and sedimentation rates in relation to physical parameters.

RESULTS/DISCUSSION

Historic analysis reveals major changes to the lower reaches of the Alafia River and its associated wetlands including diversion and dredging of the river mouth and the construction of bridges and other structures near the shore. A more subtle change was the conversion of salt marsh to mangrove, a change possibly coupled to reduction of annual riverine discharge in the Alafia. Preliminary results from SET monitoring suggest that wetland surface elevation responds to hydrologic regimes and storm events. Preliminary monitoring of small juveniles and forage fish species revealed a community dominated by anchovies, silversides, and menhaden, all schooling species. The presence of small juveniles of mullet, sheepshead, and spot that spawn offshore implies that shallow shorelines lined with salt marsh or mangrove in the lower Alafia River act as a fish nursery or rearing area.

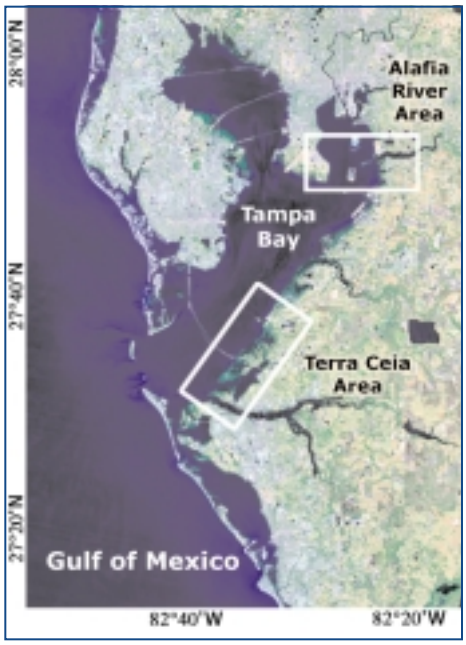

Figure 1. Satellite image of Tampa Bay indicating demonstration study sites near the Alafia River and Terra Ceia area. Colors are near natural; healthy plants are green, agricultural fields are pink or beige.

Wetland distribution in the Terra Ceia Aquatic and State Buffer Preserve is decidedly more complex (Fig. 2). Presently the peninsula consists primarily of brackish ponds of karst origin imbedded in a matrix of upland plant communities. The upland area was previously farmed (Fig. 3, left panel) and mosquito ditches connected ponds to the nearest marine embayment. Tidal flow through mosquito ditches had a number of effects: (1) expansion of mangroves around the interior ponds (Fig. 3, right panel); (2) increased pond salinities; (3) increased surface water salinity extends into the groundwater in a zone up to 40-60 meters wide and at least 5 meters deep around ditched ponds (Fig. 4); and (4) the presence of estuarine resident fish that complete their entire life cycle in the ponds or their connecting ditches and are well adapted to highly variable salinities. Despite having been connected to tidal flow, these ditched ponds do not appear to be primary nursery areas for estua-

rine transient fishes like ladyfish or spot that breed offshore in the Gulf of Mexico. Such juvenile fishes are found, however, in Frog Creek and its naturally connected tidal ponds and embayments (Fig. 2). Planned restoration activities for portions of the Aquatic and Buffer Preserve include selective filling of mosquito ditches to convert some brackish ponds to freshwater, thereby promoting a greater diversity of foraging opportunities for birds and bats.

SUMMARY

- Reduction of freshwater inflow in the Alafia River is coincident with conversion of salt marsh to mangrove vegetation at locations in the lower portion of the river. Future studies will explore possible causative factors of this vegetation change.
- Tidal channels in both the Alafia River and at Terra Ceia provide year-round habitat for resident fishes as well as nursery habitat for transient fishes that are spawned offshore. In contrast, the many brackish ponds at Terra Ceia are dominated by resident fish species.
- Several identified faunal and floral species will effectively serve as ecological indicators of environmental conditions, both natural and anthropogenic.
- Monitoring sites will assist in linking wetland conditions to environmental parameters such as hydrodynamics, climate change, water and sediment quality.

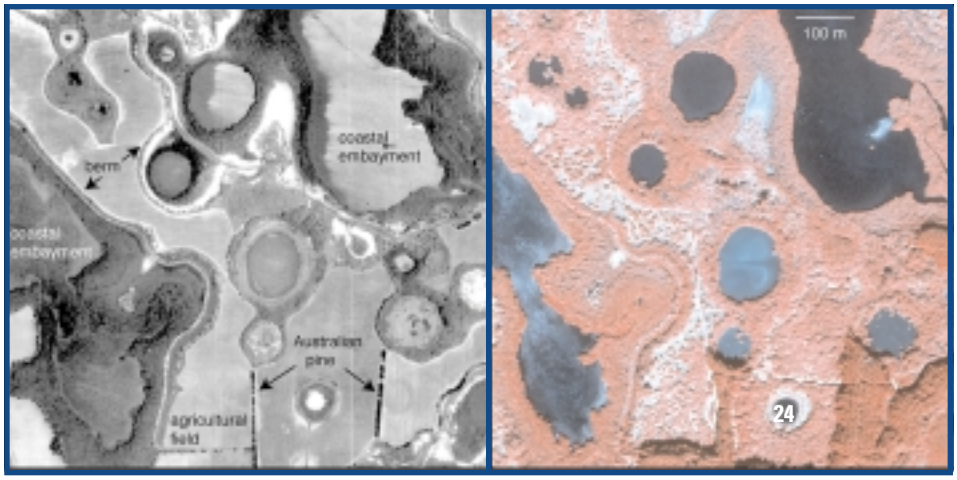

Figure 3. Intensive agriculture surrounds circular karst ponds in 1951 (left) on Terra Ceia Aquatic and State Buffer Preserve. Embayments are lined with mangroves, and distinctive berms for field protection are in place. Linear features at photo bottom are windbreaks of introduced Australian pine. In 1999, after years of disuse and addition of mosquito ditches, all karst features but one (pond 24) are now brackish and lined with mangroves (right). Exotic scrub species have colonized the fields, and Australian pine dominates the lower landscape.

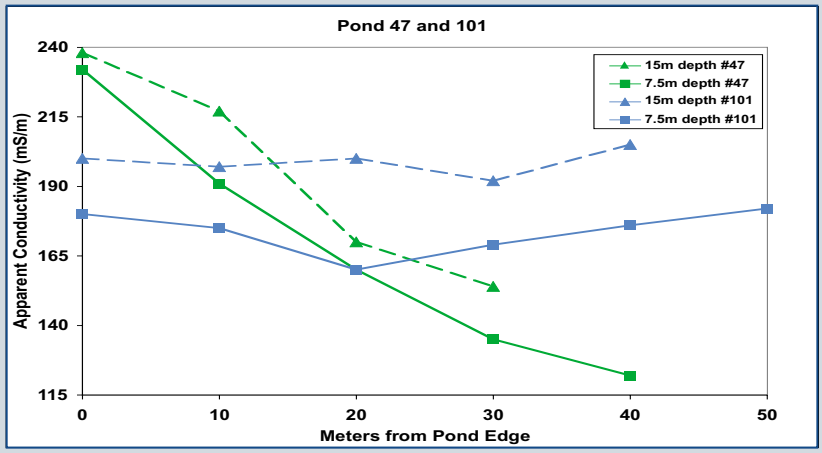

Figure 4. Apparent bulk ground conductivities from the uppermost 7.5 meters (blue lines) and uppermost 15 meters (green lines) versus distance from the edge of two ponds differing in their hydrological connection to seawater: pond 47 is connected directly to an embayment of Tampa Bay via a mosquito control ditch; pond 101 is connected less directly by natural tidal flooding along a 3-km-long section of Frog Creek (see Fig. 2). Highly conductive ground is associated with seawater saturation. This graph indicates that saline pond water mixes with surrounding fresher groundwater, and that fresher water near the surface is underlain by more saline water.

LINKS TO OTHER TAMPA BAY RESEARCH

The relative contributions of tidal exchange, groundwater and rainfall will be linked to fluctuations in salinity, water levels in the wetlands and ponds, and wetland elevation. These factors are critical to fish, wading birds and vegetation communities. Tracking these factors before and after hydrological restoration will aid in judging restoration success at Terra Ceia, and help refine future restoration plans. At the Alafia River, reductions in freshwater inflow to the bay will be linked to the apparent conversion of salt marsh to mangrove wetlands. Baywide, these two wetland types will be evaluated as contrasting habitat for estuarine fish. Analysis of recent historic change in the wetlands will be linked to pre-history (core analysis) and alterations to fresh water discharge, bathymetry, and sea level fluctuations. Urbanization modeling efforts will be combined with information on wetland distribution to develop predictive models of future wetlands change.

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